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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/293,188	04/16/1999	ZHIPING YIN	11675.165.1	4546

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TRASK BRITT
P.O. BOX 2550
SALT LAKE CITY, UT 84110

EXAMINER	
CAO, PHAT X	

ART UNIT	PAPER NUMBER
2814	

DATE MAILED: 06/05/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/293,188	YIN ET AL.	
	Examiner	Art Unit	
	Phat X. Cao	2814	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *13 March 2006*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *31-38 and 40-48* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *31-38, 40-48* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

1. The cancellation of claims 1-30 and 39 in Paper filed on 3/13/06 is acknowledged.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 31-35, 36-38, 40-44, and 45-48 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sekiguchi et al (US. 5,780,908) in view of Liao (US. 6,114,238).

Regarding claims 31, 33-34, 36, 40-43, and 45-47, Sekiguchi (Figs. 3a-3b) discloses a method of forming an electrically conductive structure, comprising: forming a first dielectric layer 4 on a silicon semiconductor structure 1, the first dielectric layer 4 comprising a depression 5 therein; filling the depression 5 with an unoxidized electrically conductive material 7 of tungsten; and reacting a chemical composition with an upper surface of the tungsten electrically conductive material 7 by exposing the surface of the tungsten conductive material 7 to plasma in an atmosphere of nitride (column 12, lines 31-37) or ammonia (NH3) (column 15, lines 50-54) for nitriding an area in the vicinity of the surface of the tungsten conductive material 7 to form a chemical compound layer 7b of tungsten nitride (column 12, lines 35-37), wherein the plasma in an atmosphere of

ammonia allows ions of ammonia (NH3) to enter or adsorb the tungsten conductive material 7 (column 11, lines 28-35).

It is noted that where the claimed and prior art products are identical or substantially identical in structure or composition, or are produced by identical or substantially identical processes, claimed properties or functions are presumed to be inherent. *In re Best*, 195 USPQ 430, 433 (CCPA 1977). Therefore, the tungsten nitride chemical compound layer 7b of Sekiguchi would have properties of providing more resistant to oxidation than the tungsten conductive material 7 because the chemical compound layer 7b of Sekiguchi is substantially identical in structure or composition (i.e., tungsten nitride) to the chemical compound layer 32 of Applicant (see page 11 of Applicant's specification, lines 4-7) and because the chemical compound layer 32 of Applicant is produced by substantially identical processes (i.e., exposing the surface of tungsten refractory material to plasma in an atmosphere of ammonia, NH3).

Sekiguchi does not disclose the forming of a second dielectric layer over the conductive material and the first dielectric layer, and being adhered to the conductive material.

However, Liao (Fig. 2D) teaches the forming of an inter-metal dielectric or a second dielectric layer 108 (not shown in Fig. 2D, see Fig. 1 and column 2, lines 64-67)) over the conductive material (208, 212a) and the first dielectric layer 202. Accordingly, it would have been obvious to form a second dielectric layer over the conductive material 7b and the first dielectric layer 4 of Sekiguchi because such second dielectric layer would provide an inter-metal dielectric for a multi-level metal interconnect

structure, as taught by Liao (see Fig. 1, column 1, lines 30-35 and column 2, lines 62-67).

Regarding claims 32, 37 and 48, as discusses above, Sekiguchi (Figs. 3a-3b) also discloses that the depression 5 is filled with a tungsten refractory metal 7, and the tungsten nitride 7b on the upper surface of the tungsten refractory metal 7 is formed by reacting the chemical composition of ammonia (NH3) with the upper surface of the tungsten refractory metal 7 (column 12, lines 31-37 and column 15, lines 50-54).

Regarding claims 38 and 44, Sekiguchi further discloses that heating the first dielectric layer 4 to a temperature of 50 degrees Celsius, and exposing the upper surface to the nitrogen-containing composition to form the chemical compound layer 7b of tungsten nitride (column 12, lines 31-37).

Regarding claim 35, Sekiguchi does not disclose that the upper surface of the conductive material is exposed to the nitrogen-containing composition for approximately 30 seconds.

However, Sekiguchi (Fig. 3b) also teaches that the upper surface of the conductive material 7 is exposed to the nitrogen-containing composition for approximately 1 minute (column 12, lines 31-37). Accordingly, it would have been obvious to expose the upper surface of the conductive material 7 of Sekiguchi to the nitrogen-containing composition for a period of time as claimed because the period of time for exposing the upper surface of the conductive material can be optimized during routine experimentation depending upon the desired resistance and the desired

thickness required for the chemical compound layer formed on the upper surface of the conductive material.

Response to Arguments

4. Applicant argues that Sekiguchi does not teach a second dielectric layer formed over an unoxidized conductive material 7 of tungsten and the first dielectric layer 4 as amended, and Liao does not teach the forming of a chemical compound over the upper surface of the unoxidized conductive material as claimed.

It should be noted that the rejection of the claimed invention is not based on anticipation, but rather, is based on obviousness. Therefore, these arguments have no immediate apparent relevance to the issues presented by the rejection because what Applicant argues is not shown by one reference is clearly taught by the other. Thus, these arguments are arguments against the references individually but, clearly, these are not proper arguments where references are applied in combination. *In re Young*, 403 F.2d 754, 757, 159 USPQ 725, 728 (CCPA 1968). The examiner relied on the combined teachings of Sekiguchi and Liao. Liao is not relied on for teaching the forming of a chemical compound over the upper surface of the unoxidized conductive material. Sekiguchi's Fig. 3b discloses the forming of a chemical compound 7b over the surface of the unoxidized conductive material 7. Liao is relied on for showing that it was known to form a second dielectric layer over the conductive plug material and the first dielectric layer in order to provide an inter-metal dielectric for a multi-level metal interconnect structure. The examiner thus regards Applicant's assertions as

constituting evidence that Applicant has failed to consider as a whole the prior art teachings disclosed by the combination of the references.

Conclusion

5. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Phat X. Cao whose telephone number is 571-272-1703. The examiner can normally be reached on M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on 571-272-1705. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

PC
May 28, 2006

PHAT X. CAO
PRIMARY EXAMINER